

AMERICAN ORIGIN OF THE CULTIVATED CUCURBITS¹

I. EVIDENCE FROM THE HERBALS

II. SURVEY OF OLD AND RECENT BOTANICAL EVIDENCE

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INTRODUCTION

There are four species of *Cucurbita* that rank as cultivated plants (*C. Pepo* L.; *C. moschata* Poir.; *C. maxima* Duch.; and *C. ficifolia*² Bouché), and there is good archeological evidence that the first three were present in the Americas in pre-Columbian times (see Carter, '45). However, it has never been decisively demonstrated that this group may not have been common to both Old and New Worlds as seems to have been the case with the white-flowered gourd, *Lagenaria sicerea* (Molina) Standl.

In the course of his investigation on the association of the cultivated cucurbits with the various Amerind cultures of the Southwest, the writer had occasion to examine most of the published work that concerns the origin of this group. The present report is an attempt to evaluate this evidence, and draw the indicated conclusions.

With the exception of *Cucurbita ficifolia*, the four species with which we are concerned are annuals. All have 20 pairs of chromosomes. They rarely, if ever, produce species hybrids, except by means of artificial pollination, and then only with difficulty. Up to the present, none have been discovered in the indigenous state.

I. EVIDENCE FROM THE HERBALS

The herbals of the 16th and early part of the 17th centuries are invaluable sources of information in tracing the origins of the cultivated species of *Cucurbita*. Prior to the establishment of contact with the New World in 1492, the herbals contained no recognizable description or illustration of these plants. Surely plants as large and distinctive in vine and fruit as squash and pumpkins would not have escaped the notice of an astute group of observers such as the herbalist-scholars of the 15th century appeared to be. A century after the discovery of America, the record as traced through the various herbals indicates that two of the annual

¹An investigation carried out while a Fellow of the John Simon Guggenheim Memorial Foundation, 1946-1947. The writer is grateful to the Director, Librarian, and staff of the Missouri Botanical Garden for their courtesy in making available for study the excellent collection of pre-Linnean literature found at that institution. Thanks are due to Professor Edgar Anderson for his customary stimulating advice and criticism.

²*Cucurbita ficifolia* is ordinarily not thought of as a cultivated plant. The work of the Russian investigators Bukasov, Zhiteneva ('30), Parodi ('34), and more recently the collections of Sauer, West, and others (personal communications), indicate that it has a long history of cultivation, and must be regarded as a cultigen. There are no archeological records of its occurrence. It is a perennial with 20 pairs of chromosomes.

species of *Cucurbita* had reached Europe, and one of them (*C. Pepo*) was represented by several varieties.

Fuchs (1542) seems to have been the first herbalist to note a cultivated cucurbit and produce a recognizable figure of it. His illustration, labelled "Türkisch Cucumer," is evidently some variety of *Cucurbita Pepo* (pl. 11, fig. 1). The deeply lobed leaves and general appearance of the plant suggest that it may be allied to our present-day Vegetable Marrows. From the shape of the fruit, there is reason to believe that the illustration labelled "Meer Cucumer" is a variety of *C. Pepo* currently known as "Small Sugar" (pl. 11, fig. 2). Like the illustrations of most herbalists, Fuchs' are somewhat conventionalized, in order to accommodate the plants to the size of the wood block, but there is no doubt that the figures mentioned are properly referable to *C. Pepo*.

Matthioli (1560) has an illustration of what seems to be a field pumpkin (*C. Pepo*) labelled *Cucurbita indica* (pl. 12, fig. 1). Daléchamps (1587) has a copy of this plate, which Seringe (1828) improperly assigns to *C. moschata*. Although the leaves are not as strongly dissected as typical *C. Pepo*, the pattern of the remaining morphological characteristics makes it seem certain that the plant is referable to this species.

Dodoens (1563) has produced a figure (*Pepones lati*) of what appears to be a form of *Cucurbita Pepo*. Judging from the shape of the fruit and the lack of tendrils, this form must be closely related to the present-day variety "White Bush Scallop" (pl. 12, fig. 2). Daléchamps (1587), in his *Historia generalis plantarum*, has illustrated, for the first time, a warted variety of *C. Pepo* under the name *Cucurbita verrucosa* (pl. 12, fig. 3). Bauhin (1650-51) has a reversed copy of Daléchamps' figure, and Bailey ('29) is undoubtedly correct in assigning it to *C. Pepo* even though the leaves and flowers do not conform very closely to this species.

Lobelius (1591) illustrates five varieties of *Cucurbita Pepo* (*Pepo oblongus*, *Pepo rotundus compressus Melonis effigie*, *Melo-pepones latiores Clypeiformes*, *Melo-pepo teres*, and *Melo-pepo compressus alter*). The fruits pictured under the label *Melo-pepones latiores Clypeiformes* are identifiable without doubt as a form of the scallop-fruited summer squash, probably the variety "Golden Custard" (pl. 12, fig. 4). Although definitely *C. Pepo*, the remainder are difficult to homologize with any of our present-day varieties. In addition, Lobelius has produced the first illustration of a plant definitely referable to *C. maxima*, under the name *Pepo maximus Indicus compressus* (pl. 12, fig. 5).

Tabernaemontanus (1591) is particularly rich in the number of varieties of *Cucurbita Pepo* which are illustrated. A total of nine forms are figured, some of which can be recognized as closely allied to our present-day varieties. *Melopepo clypeatus* is undoubtedly a form of the "White Bush Scallop" summer squash; *Cucurbita capitata* is much like the former with a slightly different fruit shape. *Melo-pepo teres* and *M. compressus* are apparently bush forms since they lack tendrils. The shape of the fruit indicates that *Pepo maximus oblongus* is probably a

Vegetable Marrow type; the same is true for *Pepo Indicus minor oblongus*. The form designated as *Pepo Indicus minor rotundus* is quite similar in shape to our modern variety, "Perfect Gem." *Pepo Indicus minor clypeatus* and *Pepo Indicus minor angulosus* (pl. 12, fig. 6) are forms whose fruit shape and general appearance are strongly reminiscent of the modern "Table Queen" or "Acorn" squash.

The results of this survey provide strong evidence that none of the cultivated species of *Cucurbita* were known to the botanists of the Western World before 1492³. In the following century at least two species (*C. Pepo* and *C. maxima*) were recognized by the herbalists, and for one of them (*C. Pepo*) a number of varieties were known. It seems strange that *C. moschata* was not introduced into Europe during this period. There may be several reasons for this: (1) In general, this species is more subject to range restrictions by low temperatures and short days than either *C. Pepo* or *C. maxima*; (2) recent distribution data indicate that it is found only in the more inaccessible regions of Mexico, Central America, and Colombia.

Cucurbita ficifolia, with its relatively hard shell and rather coarse, stringy flesh, lacks the edible qualities of the annual species. This may have been the chief reason for its neglect by the early explorers. Furthermore, this species requires a relatively long photoperiod, and it is doubtful whether it would mature fruits in Europe, except perhaps in the extreme southern portions and under exceptionally favorable cultural conditions.

II. SURVEY OF OLD AND RECENT BOTANICAL EVIDENCE

Evidence for the Old World origin of the cultivated species of Cucurbita.—

The concept that the cultivated species of *Cucurbita* were indigenous to the Old World appears to have originated with Naudin (1856). At the beginning of his extensive and illuminating memoir, which has laid the experimental foundation for our understanding of the species of this group, he devotes a single paragraph to their origin. He states that of the six known species (*C. moschata*, *C. Pepo*, *C. maxima*, *C. melanosperma*, *C. perennis*, and *C. digitata*) the first three have been cultivated for a considerable length of time in Europe. The nativity of *C. maxima* is admittedly undetermined. It is claimed, without documentation, that *C. Pepo* has been known to the Romans and Greeks at least since the time of Pliny. According to Naudin, *C. maxima* and *C. moschata* are more modern introductions into European gardens ("leur introduction dans nos jardins ne remontant guère au delà de deux siècles").

³Sturtevant ('19, p. 219) has summarized this line of evidence in a remarkable lucid statement, "If we consider the stability of types and the record of variations that appear in cultivated plants, and the additional fact that, so far as determined, the originals of the cultivated types have their prototypes in nature and are not the products of culture, it seems reasonable to suppose that the record of the appearance of types will throw light upon the country of their origin. From this standpoint, we may, hence, conclude that, as the present types have all been recorded in the Old World since the fifteenth century and were not recorded before the fourteenth, there must be a connection between the time of discovery of America and the time of appearance of pumpkin and squashes in Europe."

Naudin, in discussing *Cucurbita ficifolia* (*C. melanosperma* Gaspar.), states that it was introduced into Europe about 1800 A. D., probably from southern Asia as indicated from its common name, "Courge de Siam." Reports of travelers led him to believe that at this time it was grown in China on a large scale; thus confirming his opinion that the species originated in Asia. Naudin thought that *C. ficifolia* has important potentialities as an economic plant, for use as human food if properly prepared in the immature stages, and as cattle food because of its long-keeping qualities.

In a later paper, Naudin (1859) reports further experimental work with various genera of the Cucurbitaceae. He does not make any positive statement about the origin of the cultivated cucurbits, although he infers that *C. moschata* is an Old World indigene. He states that seed of several varieties collected in India have been grown at the Museum. Since the early terminology of cucurbitaceous fruits was in much confusion, it is highly probable that Naudin has mistaken Pliny's reference to watermelons, melons, cucumbers, and gourds as including some members of the genus *Cucurbita*. There is no evidence to support the belief that Pliny was familiar with the latter group.

The widely held conviction that the three commonly cultivated species of *Cucurbita* were of other than American origin was continued by De Candolle ('83) on very slender, and for the most part, questionable evidence. Later investigators (Cogniaux, 1881; Pittier, '26; Herrera, '41) have propagated De Candolle's views without critical reexamination of their basis. From De Candolle's discussion of the origin of the four species under consideration it is apparent that he is positively in favor of an Old World origin only in the case of *Cucurbita maxima*, and there is some reason to doubt that he felt that the record was entirely convincing here. In terminating his discussion of the origin of *C. maxima* he makes the statement, "En définitive, sans ajouter une foi implicite à l'indigénat sur les bords du Niger, fondé sur le dire d'un seul voyageur, je persiste à croire l'espece originaire de l'ancien monde et introduite en Amérique par les Européens."

The best evidence De Candolle could muster for his Old World theory of the origin of *Cucurbita maxima* was Hooker's (1871) citation of localities for certain collections: i. e. "Upper Guinea. Nupe on the Niger, apparently indigenous, Barter!" Welwitsch's discovery of this species in Angola is also referred to, but there is no indication as to whether or not it was an indigenous plant. The fact that Barter's plants were collected along the banks of a large river would lead to the supposition that it was an introduced species. Welwitsch's collection was made in or around a village, and it is therefore quite likely that the plants were escapes. At best, De Candolle's arguments for an Old World origin of *C. maxima* rest on an extremely flimsy foundation.

As for *Cucurbita Pepo*, De Candolle presents the documented evidence for and against its Old World origin. His position may be summed up by stating that the historical record does not contradict the opinion that this species may be of American origin.

According to De Candolle, the origin of *Cucurbita moschata* presents an unsolved problem. However, he is inclined to attach some weight to the unproven assertion that this species was more widespread in southern Asia than in any other region during the seventeenth century. As stated previously, *C. moschata* was unknown to the botanists of the fifteenth and sixteenth centuries. The first record of its occurrence seems to be the excellent illustration published by Van Rhede in *Hortus Malibaricus* (1688). During the 17th and 18th centuries it appeared in several floras of southern Asia and Africa (Wight, 1843; Clarke, 1879; etc.). However, in no case was it claimed to be an indigenous plant.

Evidently *Cucurbita moschata* was introduced into European horticulture from southern Asia (Naudin, 1856), rather than directly from the Americas. The common names given to varieties of this species were indicative of Old World origin, i. e. "Pleine de Naples," "Pleine de Barbarie," "Muscade de Provence," etc.

De Candolle suggests that *Cucurbita ficifolia* is of American origin, since up to the time of his investigations, all the perennial species of the genus were natives to California or Mexico, whereas the annual species were assumed to be of Old World origin. This argument has now lost whatever cogency it may have had. Bailey ('43) has described several species from North America which are undoubtedly annuals.

Evidence for the New World origin of the cultivated species of Cucurbita.—

In a critical review of certain phases of De Candolle's book, Gray and Trumbull ('83) present the evidence for an American origin of the three annual species. Their report can best be summarized by quoting directly:

"Allusion has already been made (under *Lagenaria*) to the difficulty of distinguishing the genera of the *Cucurbitaceae*, under names by which they are mentioned by voyagers and explorers of the first century after the discovery of America; and the question of species is particularly difficult. Yet we find abundant evidence—especially as respects North America—(1) that in various parts of the country, remote from each other, the cultivation of one or more species of Cucurbits by the Indians was established before those places are known to have been visited by Europeans; (2) that these species or varieties were novel to Europeans, and were regarded by botanists of the 16th and 17th centuries, as well as by the voyagers and first colonists, as natives or denizens of the region in which they were found; and (3) that they became known only under American names; one of these names (*Squash*) becoming, in popular use, generic, and two others (*Macock* and *Cushaw*) surviving, as names of varieties, into the present century."

Gray and Trumbull then present strong evidence for their conclusions, following a chronological scheme as nearly as possible. First, the reports of several early explorers and historians are cited. Although it is usually difficult or impossible to determine precisely to what species these writers have reference, it is almost certain that they are concerned with one of the three annual species of *Cucurbita*, probably *C. Pepo*. The reports of the following explorers are cited: Columbus, Cuba, 1492; Cabeça de Vaca, Florida, 1528; De Soto, Florida and Mississippi, 1539-41; Cartier, Canada, 1535; Sagard, Canada, 1642; Lahontan, Southern Canada, 1703; also the historians who mentioned pumpkins, macocks and squashes—Captain John Smith, 1606-08; Strachey, 1610; Higginson, 1629; Beverley, 1705; and others.

Further support is provided by the works of the 16th century herbalists—Fuchs, Dodoens, Matthiolus, etc. It is clear, as Gray and Trumbull point out, that the Cucurbitas were considered foreign or novel by these botanists. Furthermore, the word "Indian" as applied to the area of origin of various species did not necessarily mean that they came from Asia, but rather the West Indies or the Americas. Much confusion has come about through a misinterpretation of the word "Indian." De Candolle and others have, for the most part, interpreted it in a narrow sense as applying only to British India, but the truth seems to be that *Cucurbita Pepo* and *C. maxima* reached Europe from the West Indies or directly from the American continent.

Gray and Trumbull regard Nuttall's (1818) statement of particular importance in establishing the American origin of the cultivated *Cucurbita*. Nuttall mentions two species, *C. Lagenaria* and *C. verrucosa* (Warted Squash), and of the latter, he observes, "Cultivated also by the Indians of the Missouri to its sources." *Cucurbita verrucosa* is one of the warted varieties of *C. Pepo*. Trumbull's work (1876) in tracing the Indian origin of the words squash, cushaw and macock is considered by Gray and Trumbull as being especially significant in establishing a case for the North American origin of *Cucurbita Pepo* and *C. moschata*. Trumbull states in summarizing his conclusions, "As regards North American varieties, the evidence seems conclusive. These varieties at least bear Indian names, which date from the first coming of the Europeans, and of these varieties we have no mention before they were found in North America."

Recent botanical evidence.—

The Russian plant explorers (Bukasov, '30; Zhiteneva, '30) have contributed an immense amount of data to our knowledge of the distribution of the cultivated Cucurbitas. Briefly, they have found that the greatest diversity of the group is found in Central Mexico, where *Cucurbita Pepo*, *C. moschata*, *C. mixta* (a variant of *C. moschata*), and *C. ficifolia* occur together under cultivation, in the same general area (Mesa Central). It is important to note the omission of *C. maxima* from the above list. Apparently this species has never been cultivated by the natives of Mexico, Central America, or the northern portions of South America.

Cucurbita ficifolia, according to the Russian investigators, is the most widely distributed species of the group. It is found in all countries from Mexico to Chile along the Cordillera. There are white-seeded and black-seeded forms; otherwise, the composition of the species is very stable over the entire range. *Cucurbita moschata* is almost as widely distributed as *C. ficifolia*. It is extensively grown in Mexico, Central America and Colombia, but does not extend southward to Peru and Chile. In Panama and Colombia it is the only cultivated species of *Cucurbita*. The forms found in Mexico and parts of Central America are typically white-seeded, while those of Panama and Colombia are brown-seeded. The Russians consider that the center of distribution of *C. Pepo* must lie to the north of the Mesa Central in Mexico, since it is completely absent from their South American collections, and appears only sparsely in their records from Central Mexico.

Parodi ('35) has made a significant contribution to the subject in his study of pre-Hispanic agriculture in Argentina. He finds that *Cucurbita maxima* was one of the principal species of plants cultivated by the Guarnies in northeast Argentina and Paraguay at the time of the conquest of the Rio de la Plata.

Cardenas ('44), after completing his studies of the cultivated Cucurbitas of Bolivia, comes to the conclusion that there were several varieties of *Cucurbita maxima* present in the Andean valleys of South America at the time of the conquest. On the other hand, *C. Pepo* and *C. moschata* are evidently of recent introduction into the cultivated crop complex of Bolivia, Paraguay and Argentina. He suggests that a thorough exploration of the temperate and tropical portions of Bolivia and Peru might uncover wild relatives of the cultivated cucurbits that would be helpful in deciphering their relationships. The basis for this suggestion is the discovery of a small, warted gourd (el "joko") in an isolated region of Bolivia (upper canyon of the Rio Caine). This gourd is cultivated for food and is believed to be closely related to *C. Pepo*.

SUMMARY

1. Negative evidence of the presence of *Cucurbita Pepo* and *C. maxima* in Europe prior to 1492, also familiarity of the herbalists of the 16th and 17th centuries with these species, suggest very strongly that they were introduced into Europe from the Americas.

2. An examination of the evidence in favor of the origin of the cultivated species of *Cucurbita* in the Old World indicates that it is very fragmentary, and in general unacceptable.

3. The botanical record, while not as extensive or decisive as it might be, clearly favors an American origin of the cultivated cucurbits.

4. Finally, the archaeological and botanical records lead inescapably to the conclusion that the four cultivated species of *Cucurbita*, *C. Pepo*, *C. moschata*, *C. maxima*, and *C. ficifolia*, are New World in origin. The possibility that *C. moschata* may have been common to both hemispheres is not ruled out, but it does seem relatively remote.

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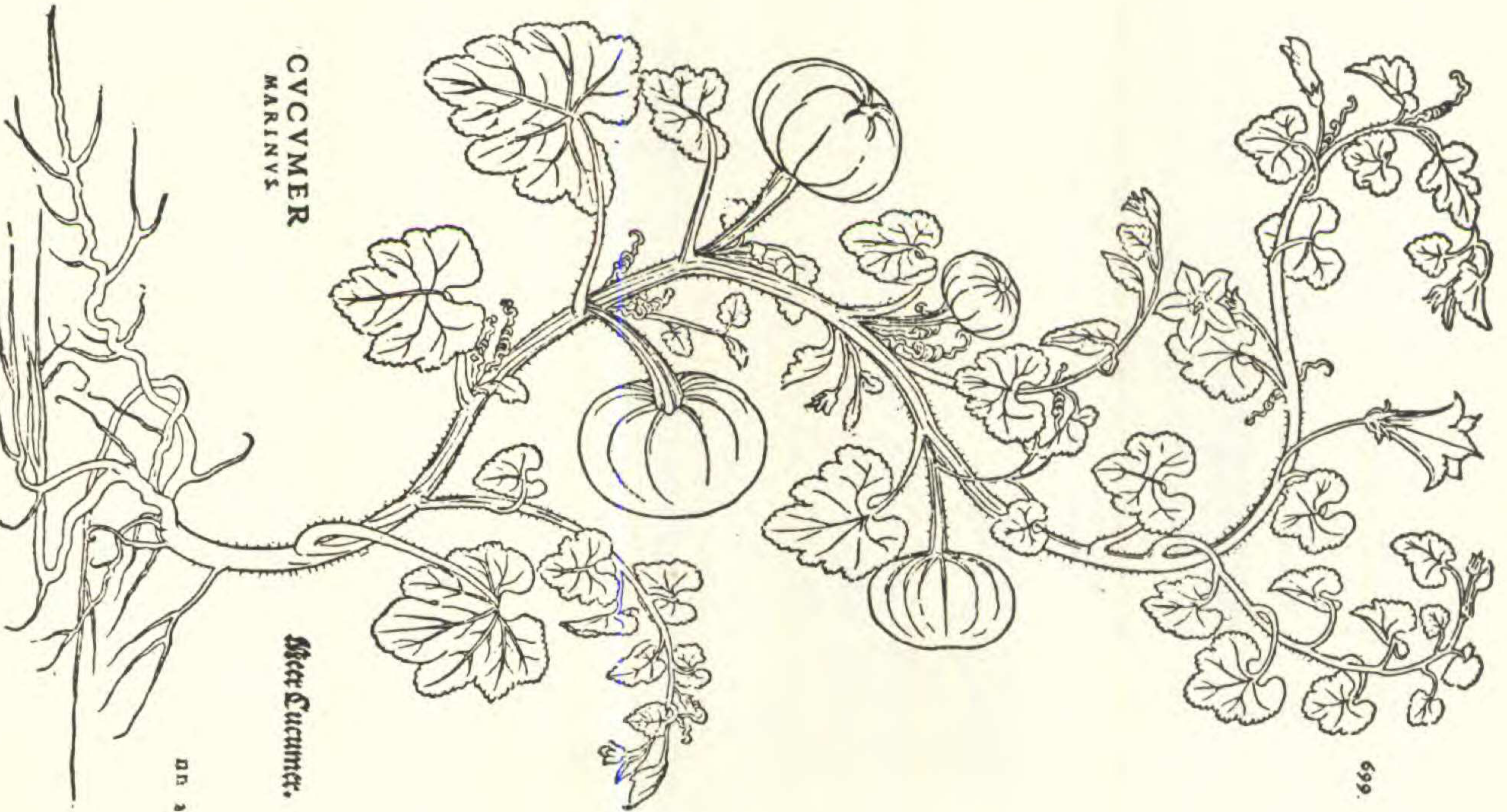
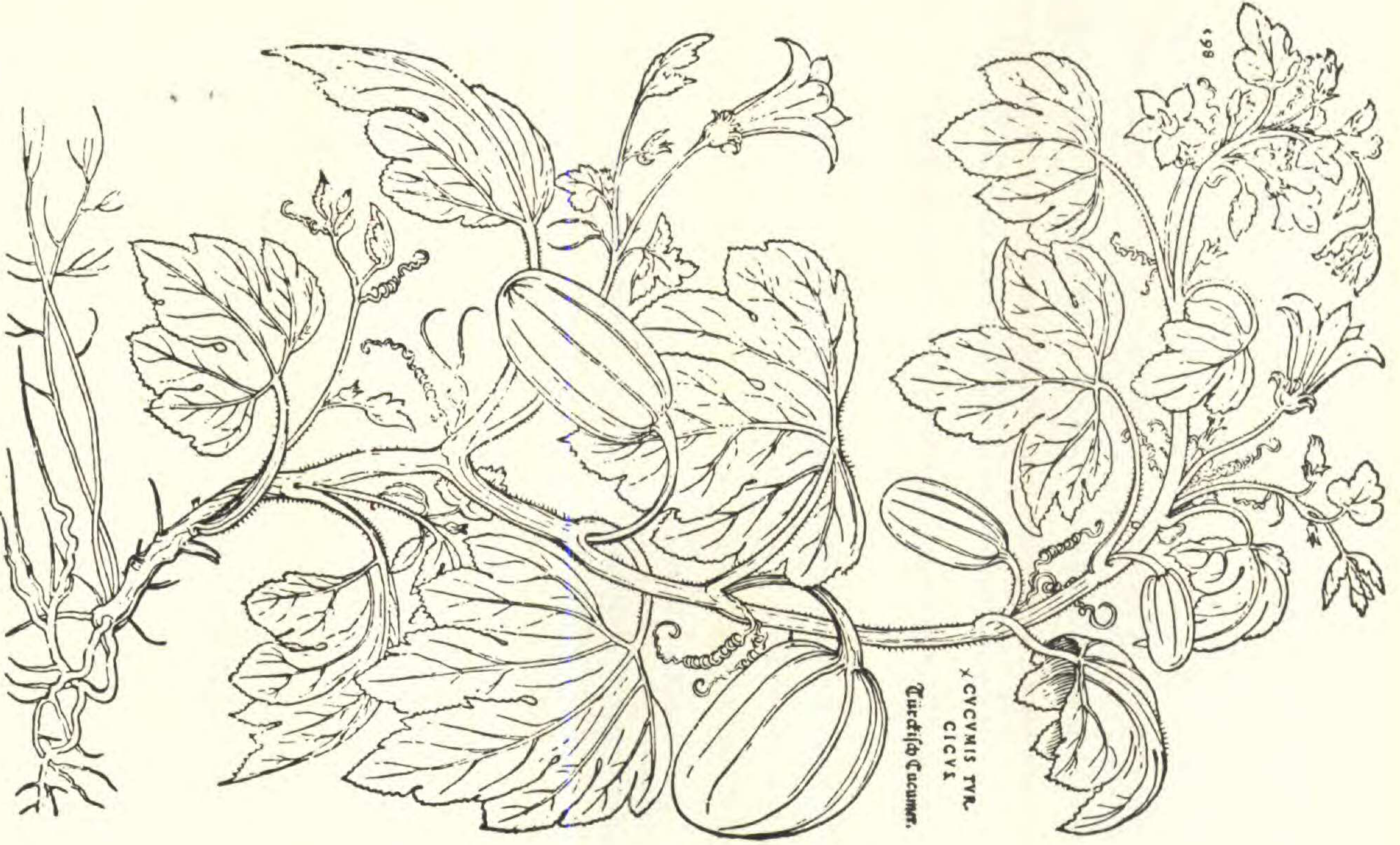
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EXPLANATION OF PLATE

PLATE 11

- Fig. 1. "Türckisch Cucumer" of Fuchs, apparently a variety of *Cucurbita Pepo*.
- Fig. 2. "Meer Cucumer" of Fuchs, evidently *C. Pepo* var. "Small Sugar."



WHITAKER—ORIGIN OF CULTIVATED CUCURBITS

CUCURBITA INDICA.



1

Pepones lati.



2

Breede Peponen.

CUCURBITA verrucosa.



3

Melo-pepones latiores Clypeiformes. T. 784.



4

Pepo maximus Indicus compressus. L. 365. T. 784.



5

Klein Indisch edelartig Peponen.
Pepo indicus minor angulosus.



6

EXPLANATION OF PLATE

PLATE 12

Fig. 1. *Cucurbita indica* from Matthioli, probably *Cucurbita Pepo*.

Fig. 2. *Pepones lati* from Dodoens—*Cucurbita Pepo*, possibly var. "White Bush Scallop."

Fig. 3. *Cucurbita verrucosa* from Daléchamps, evidently a warted variety of *C. Pepo*.

Fig. 4. *Melo-pepones latiores Clypeiformes* from Lobelius, probably *Cucurbita Pepo* var. "Golden Custard."

Fig. 5. *Pepo maximus Indicus compressus* from Lobelius—the first illustration of *Cucurbita maxima*.

Fig. 6. *Pepo Indicus minor angulosus* of Tabernaemontanus, probably *Cucurbita Pepo* var. "Table Queen."